a specified pressure by introducing gas into the vacuum chamber and simultaneously evacuating the interior of the vacuum chamber; and

processing the substrate using the generated plasma while controlling plasma distribution on the substrate using a single annular groove arranged at the electrode so that an outer-side face of the annular groove is located inside of an inner surface of a sidewall of the vacuum chamber.

57. The plasma processing method of claim 56, wherein the annular groove has a groove depth of at least 5 mm.

58. The plasma processing method of claim 56, wherein a surface area of the electrode located inside the annular groove is 0.5 to 2.5 times as large as a surface area of the substrate.

59. A method of generating plasma within a vacuum chamber and processing a substrate placed on a substrate electrode within the vacuum chamber, the method comprising:

generating the plasma by supplying power having a frequency of 50 MHz to 3 GHz to an electrode positioned opposite the substrate while maintaining an interior of the vacuum chamber at a specified pressure by introducing gas into the vacuum chamber and simultaneously evacuating the interior of the vacuum chamber; and

processing the substrate using the generated plasma while controlling plasma distribution on the substrate using an annular groove arranged outside of the electrode so that an outer-side face of the annular groove is located inside of an inner surface of a sidewall of the vacuum chamber, and so

that a surface area inside of the annular groove including the electrode is 0.5 to 2.5 times as large as a surface area of the substrate.

60. The plasma processing method of claim 59, wherein the vacuum chamber includes an insulating ring for insulating the vacuum chamber, the insulating ring being arranged on the electrode or around the electrode.

C2 cont

61. The plasma processing method of claim 60, wherein the annular groove is formed at the insulating ring.

62. The plasma processing method of claim 60, wherein the annular groove is formed by the electrode and the insulating ring.

63. The plasma processing method of claim 60, wherein the annular groove is formed by the vacuum chamber and the insulating ring.

64. A method of generating plasma within a vacuum chamber and processing a substrate placed on a substrate electrode within the vacuum chamber, the method comprising:

generating the plasma by radiating electromagnetic waves into an interior of the vacuum chamber via a dielectric window positioned opposite the substrate by supplying power having a frequency of 50 MHz to 3 GHz to an antenna while maintaining the interior of the vacuum chamber

at a specified pressure by introducing gas into the vacuum chamber and simultaneously evacuating the interior of the vacuum chamber; and

processing the substrate using the generated plasma while controlling plasma distribution on the substrate using a single annular groove arranged at the dielectric window so that an outer-side face of the annular groove is located inside of an inner surface of a sidewall of the vacuum chamber, and so that the annular groove has a groove width in a range of 3 mm to 50mm.

C2 cont

65. The plasma processing method of claim 64, wherein a surface area of the dielectric window located inside the groove is 0.5 to 2.5 times that of the substrate.

66. A method of generating plasma within a vacuum chamber and processing a substrate placed on a substrate electrode within the vacuum chamber, the method comprising:

generating the plasma by radiating electromagnetic waves into an interior of the vacuum chamber via a dielectric window positioned opposite the substrate by supplying power having a frequency of 50 MHz to 3 GHz to an antenna while maintaining the interior of the vacuum chamber at a specified pressure by introducing gas into the vacuum chamber and simultaneously evacuating the interior of the vacuum chamber; and

processing the substrate using the generated plasma while controlling plasma distribution on the substrate using an annular groove arranged outside of the dielectric window so that an outer-side face of the annular groove is located inside of an inner surface of a sidewall of the vacuum chamber, and so that a surface area inside of the annular groove including the dielectric window is 0.5 to 2.5

times as large as a surface area of the substrate, and so that the annular groove has a groove width in a range of 3 mm to 50 mm.

67. The plasma processing method of claim 66, wherein the annular groove is formed by an upper wall of the vacuum chamber and the dielectric window.

C2 CONT

68. A plasma processing apparatus comprising:

a vacuum chamber having an upper inner surface opposite a substrate to be placed in said vacuum chamber, and having a sidewall;

a gas supply device for supplying gas into said vacuum chamber;

an evacuating device for evacuating an interior of said vacuum chamber;

a substrate electrode for supporting the substrate within said vacuum chamber;

an opposite electrode arranged opposite said substrate electrode;

a single annular groove arranged at said opposite electrode so that an outer-side face of said annular groove is located inside of an inner surface of said sidewall of said vacuum chamber; and

a high-frequency power supply source for supplying power having a frequency of 50 MHz to 3 GHz to said opposite electrode.

69. The plasma processing apparatus of claim 68, wherein a surface area of said opposite electrode inside of said annular groove is 0.5 to 2.5 times as large as a surface area of the substrate.

70. The plasma processing apparatus of claim 68, wherein said annular groove has a groove depth of at least 5mm.

71. A plasma processing apparatus comprising:

a vacuum chamber having an upper inner surface opposite a substrate to be placed in said vacuum chamber, and having a sidewall;

a gas supply device for supplying gas into said vacuum chamber;

an evacuating device for evacuating an interior of said vacuum chamber;

a substrate electrode for supporting the substrate within said vacuum chamber;

an opposite electrode arranged opposite said substrate electrode;

an annular groove arranged outside of said opposite electrode so that an outer-side face of said annular groove is located inside of an inner surface of said sidewall of said vacuum chamber, and so that a surface area inside of said annular groove including said opposite electrode is 0.5 to 2.5 times as large as a surface area of the substrate; and

a high-frequency power supply source for supplying power having a frequency of 50 MHz to 3 GHz to said opposite electrode.

72. The plasma processing apparatus of claim 71, further comprising an insulating ring for insulating said vacuum chamber, said insulating ring being arranged on or around said opposite electrode so that said annular groove is formed by said opposite electrode and said insulating ring.

73. The plasma processing apparatus of claim 71, further comprising an insulating ring for insulating said vacuum chamber, said annular groove being formed at said insulating ring.

74. The plasma processing apparatus of claim 71, further comprising an insulating ring for insulating said vacuum chamber, said annular groove being formed between said insulating ring and said opposite electrode.

75. The plasma processing apparatus of claim 71, further comprising an insulating ring for insulating said vacuum chamber, said annular groove being formed between said insulating ring and said vacuum chamber.

76. A plasma processing apparatus comprising:

a vacuum chamber having an upper inner surface opposite a substrate to be placed in said vacuum chamber, and having a sidewall;

a gas supply device for supplying gas into said vacuum chamber;

an evacuating device for evacuating an interior of said vacuum chamber;

a substrate electrode for supporting the substrate within said vacuum chamber;

a dielectric window arranged opposite said substrate electrode;

a single annular groove arranged at said dielectric window so that an outer-side face of said annular groove is located inside an inner surface of said sidewall of said vacuum chamber, said annular groove having a groove width in a range of 3 mm to 50 mm;

an antenna for radiating electromagnetic waves into said vacuum chamber via said dielectric window; and a high-frequency power supply source for supplying power having a frequency of 50 MHz to 3 GHz to said antenna.

77. The plasma processing apparatus of claim 76, wherein a surface area of said dielectric window located inside said annular groove is 0.5 to 2.5 times as large as a surface area of the substrate.

C_{cont}^{2}

78. A plasma processing apparatus comprising:

a vacuum chamber having an upper inner surface opposite a substrate to be placed in said vacuum chamber, and having a sidewall;

a gas supply device for supplying gas into said vacuum chamber;

an evacuating device for evacuating an interior of said vacuum chamber;

a substrate electrode for supporting the substrate within said vacuum chamber;

a dielectric window arranged opposite said substrate electrode;

an annular groove arranged outside of said dielectric window so that an outer-side face of said annular groove is located inside of an inner surface of said sidewall of said vacuum chamber, and so that a surface area inside of said annular groove including said dielectric window is 0.5 to 2.5 times as large as a surface area of the substrate, said annular groove having a groove width in a range of 3 mm to 50 mm;

an antenna for radiating electromagnetic waves into said vacuum chamber via said dielectric ~~window; and~~

C 2 a high-frequency power supply source for supplying power having a frequency of 50 MHz to 3 GHz to said antenna.

79. The plasma processing apparatus of claim 78, wherein said annular groove is formed by an upper wall of said vacuum chamber and said dielectric window.